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Knowledge retention in ERP implementations: the context of UK SMEs

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Abstract:

Knowledge retention (k-retention) is vital for various enterprise resource planning (ERP) implementations in Small and Medium-sized Enterprises (SMEs), although it is a highly demanding and challenging task. The aim of this paper is to investigate different types of k-retention approaches and factors influencing k-retention. This study adopts a grounded theory approach with 12 cases implemented in UK SMEs. We analyse our data using thematic analysis. Our findings reveal specific elements that support the k-retention of ERP package knowledge and business process knowledge. These elements are k-retention tools, documentation, human capital, and the understanding of k-retention challenges. In addition to insights from these aspects, our study reveals two factors (i.e. project management and organisational culture) and how these factors influence ERP package k-retention and business process k-retention. Based on these findings, we develop an ERP k-retention (EKR) framework that can be utilised by those SMEs which may consider implementing ERP systems — obtaining various methods and directions to retain knowledge during ERP implementations.

Keywords: Enterprise resource planning; ERP implementation; knowledge management; knowledge retention; UK SMEs; EKR framework

1. Introduction

In today's economy, knowledge is one of the most important resources in creating a competitive advantage for organisations (R McAdam and Galloway 2005; Sue. Newell 2015). Knowledge

management (KM) has become a critical component of an organisation's arsenal, and organisations are beginning to pay more attention to it. However, most KM research is focused on large organisations and addresses perspectives such as KM strategy, KM implementation, or performance based on KM, among others (Donate and Guadamillas 2011; S. Liu et al. 2014; Uchitha Jayawickrama, Liu, and Hudson Smith 2014). Rodney McAdam and Reid (2001) found that large organisations recognised knowledge and its various aspects and had more resources to develop a KM strategy and systems. Small and Medium-sized Enterprises (SMEs), however, have less available resources, and their KM and k-retention practices are divergent and less advanced when compared to large organisations (Amani and Fadlalla 2016; Carvalho and Guerrini 2017) KM involves knowledge creation, knowledge transfer, knowledge retention and knowledge application; therefore, knowledge retention is a part of KM lifecycle which has specialised approaches, activities and tools associated with it (Sedera and Gable 2010; U. Jayawickrama, Liu, and Hudson Smith 2016).

Over 99% of businesses in the UK and European Union (EU) are SMEs; number of employees between 0 and 249, and annual turnover not exceeding €50 million considered as a SME based on the EU definition of SME (Schoenherr et al. 2010). SMEs are heavily investing in Enterprise resource planning (ERP) systems to integrate and automate their business processes seamlessly in order to minimise wastage and costs, and achieve higher profits (Metaxiotis 2009). ERP systems are information systems that are essential for organisations to improve business processes, minimise information redundancy and improve information integrity (Shin 2006; Supyuenyong, Islam, and Kulkarni 2009). Over the past two decades, ERP systems have become one of the most important and expensive implementations in the corporate use of information technology.

Despite the benefits that can be achieved from a successful ERP system implementation, there are evidence of high failures of ERP implementation projects in numerous industries (Huang et al. 2004; Uchitha. Jayawickrama and Yapa 2013; Sun, Ni, and Lam 2015). One of the main reasons for ERP failures has been identified as the lack of sufficient support from KM approaches (such as knowledge retention approaches) throughout the ERP project lifecycle in SMEs (Sedera and Gable 2010; Uchitha Jayawickrama, Liu, and Hudson Smith 2013; Metaxiotis 2009). There are several research efforts gone in developing scientific solutions for knowledge-based issues ERP implementations in SME. Metaxiotis (2009) aims to explore the rationales for the integration of knowledge management and ERP in SMEs and to present a conceptual model for their integration. Supyuenyong, Islam, and Kulkarni (2009) investigate how the special characteristics of SMEs influence their KM processes in their qualitative study with ERP service providers. However, these studies lack the focus on knowledge retention phase. Amani and Fadlalla (2016) also revealed that although many ERP research studies discussed KM in general, knowledge creation and knowledge transfer/sharing, there is a clear lack of research efforts particularly in the area of knowledge retention as far as ERP and SME domains are concerned. Being SMEs, it would be helpful to know practical and cost-effective ways of knowledge retention during ERP implementation in order to use them in the post-implementation stage when they have no support from implementation partner. Therefore, after generating and transferring knowledge into multiple stakeholders, it is absolutely essential to retain/store that relevant and up-to-date knowledge in right quantities to re-use them in future. Implementation of ERP systems in organisations requires a variety of complex and detailed knowledge in order to gain measurable business benefits (R McAdam and Galloway 2005; Sue. Newell 2015). Effectively retaining a wide range of knowledge that resides in multiple stakeholders, including experienced implementation consultants and business users/representatives, has been identified as a crucial factor for ERP project success (Q. Xu and Ma 2008). Therefore, this study

attempts to investigate on knowledge retention approaches of different types of knowledge, and factors influence knowledge retention.

There are several key contributions to the existing body of knowledge through this study; four elements that support the knowledge retention of ERP package knowledge and business process knowledge. These are the knowledge retention tools, documentation, human capital, and understanding of knowledge retention challenges. In addition to contributions from these aspects, the study reveals two factors (i.e. project management and organisational culture) and how these factors influence ERP package knowledge retention and business process knowledge retention. This study also contributes to the existing body of knowledge by developing an ERP knowledge retention (EKR) framework that can be utilised by practitioners in SMEs which may implement ERP systems, ultimately retaining knowledge better practices.

The rest of the paper is organised as follows: Section 2 presents the theoretical basis for the study, while Section 3 presents the grounded theory approach based research methodology. Section 4 presents empirical findings and Section 5 concludes this paper, along with discussion.

2. Theoretical basis for the study

This section discusses existing literature relevant to this study which covers the aspects of knowledge types, KM lifecycle, knowledge retention, and KM for ERP in SME context.

2.1 Knowledge types

The knowledge types are essential to understand a particular substance in a great detail. The whole pool of knowledge pertaining to ERP implementation can be categorised into different knowledge types to investigate issues on KM for ERP implementation (Gable 2005). And this section evaluates how and why knowledge types have been used in past studies specifically into ERP knowledge management. Davenport (1998) identifies three types of knowledge which need to be managed during ERP implementation (1) software-specific knowledge, (2) business process knowledge (3) organisation-specific knowledge. Sedera, Gable, and Chan (2003) combine (2) and (3), and define as "knowledge of the client organisation". They denote software-specific knowledge as "knowledge of the software". Gable, Sedera, and Chan (2008) and Sedera and Gable (2010) have used the same two knowledge types to explain and categorise enterprise systems knowledge. Furthermore, both the studies state that knowledge of the software is low with clients, medium with consultants and high with vendors; whereas, knowledge of the client organisation is low with vendors, medium with consultants and high with clients. It is clear that knowledge of the software is mostly the knowledge external to the client organisation and knowledge of the client organisation is internal to the organisation. Jayawickrama, Liu, and Hudson Smith (2017) identified and prioritised four key knowledge types in their study; ERP package knowledge and business process knowledge have been ranked as most important knowledge types to achieve ERP project success by both clients and implementation partners. Whereas organisational cultural knowledge and project management knowledge have been ranked as least important knowledge types by both parties. Furthermore, ERP package knowledge and project management knowledge can be considered as external knowledge to the client organisation (Lin and Ha 2015; Amani and Fadlalla 2016), whereas business process knowledge and organisational cultural knowledge can be considered as internal knowledge to the client organisation. Current study has used these two most important knowledge types as a starting point for this research inquiry.

Parry and Graves (2008) also argue about two distinct types of knowledge required for ERP implementations, i.e. knowledge internal to the client organisation and knowledge external to the client organisation. Knowledge of ERP functionality, use of ERP, basic ERP system and IT infrastructure, programming and best business practices unfold under external knowledge. Internal knowledge comprises of the knowledge of business processes and legacy systems in place in the client organisation, according to the knowledge centres of Parry and Graves (2008). The common pattern of external knowledge and internal knowledge to the client company is evident from past literature.

Furthermore, O'Leary (2002) investigates specifically on financial transaction knowledge under ERP package knowledge which is external knowledge to client, and discusses it across the entire cycle of an ERP system; staring from choosing the ERP system, implementing, use and maintaining the same. P. Liu (2011) reveals the influence of critical success factors on ERP knowledge management, but this study only examines one knowledge type which is ERP knowledge. It identifies the critical success factors for knowledge management, they are; (1) support from senior managers and corporative visions, (2) reengineering and project management, (3) appropriate consultants and software suppliers, (4) proper employee and educational training. The study reveals the positive relationship between these critical success factors (CSF) and management performance. Also, it discovers the importance of four CSFs to achieve ERP knowledge management. Although this study has not directly discussed knowledge types, it has used knowledge external to client in other words ERP package knowledge in order to discover the positive relationship between 4 factors to achieve ERP knowledge management by investigating knowledge flow between various stakeholders such as consultants, senior managers and end users.

S Newell et al. (2003) examine on simultaneous implementation of an ERP system and KM system in order to facilitate simultaneous development of organisational efficiency and flexibility. The study matches the objectives and characteristics of ERP and KM system, and attempts to synchronise the implementation of both simultaneously. Moreover, it compares and contrasts the impact of ERP initiative and KM initiative for the simultaneous implementation. However, the study largely explains only the ways and means of managing ERP product related knowledge through KM systems, not any other knowledge internal to client organisation.

The common pattern identified from past studies specifically on ERP implementation is that ERP related knowledge is either internal or external to the client organisation based on the knowledge types (k-types) discussed in this section.

2.2 KM lifecycle

The KM lifecycle or knowledge management process is a systematic process comprises of multiple phases (Sedera and Gable 2010). KM defines as creating value from intangible assets of an organisation and best leverage knowledge internally and externally by Liebowitz (2000). Horwitch and Armacost (2002) describe KM as a continuous process of creation, transfer, retention and application of the right level of knowledge, at the right time, with the right people. The number of phases would depend on the application of it to a particular context. There are several research studies that have investigated the effective use of KM lifecycle to manage various types of knowledge when implementing ERP systems. Table 1 demonstrates the KM lifecycle phases and the number of phases used by previous studies.

Table 1: KM lifecycle phases

No	Author	Phases of KM lifecycle					No. of phases
1	Alavi and Leidner (2001)	Creation	Storage	Transfer	Application		4
2	Holsapple and Singh (2001)	Acquisition	Selection	Generation	Internalisation	Externalisation	5
3	Horwitch and Armacost (2002)	Create	Capture	Transfer	Access		4
4	Gable (2005)	Creation	Transfer	Retention	Reuse		4
5	Parry and Graves (2008)	Use	Create	Organise	Disseminate		4
6	Metaxiotis (2009)	Creation	Organisation	Sharing	Use		4
7	Sedera and Gable (2010)	Creation	Transfer	Retention	Application		4
8	Candra (2014)	Creation	Retention	Transfer	Application		4
9	U. Jayawickrama, Liu, and Hudson Smith (2016)	Creation	Transfer	Retention	Application		4

Although above studies in Table 1 cover the full spectrum of KM lifecycle, they lack the in-depth investigation on each phase of KM lifecycle. In addition, they have not been able to address how and what KM tools and techniques used in each phase during ERP implementation. There are a small number of studies that have specifically looked at only one KM lifecycle phase such as knowledge creation and knowledge transfer (see Table 2). However, no studies have found which have specifically investigated knowledge retention for ERP implementation. As indicated in Table 1, knowledge retention is a common and important phase in KM lifecycle, but has not received adequate research attention as yet.

Table 2: Past studies investigated only on one KM lifecycle phase

No	KM lifecycle phase	References
1	Knowlege transfer	Jones, Cline, and Ryan (2006), Q. Xu and Ma (2008), Hung et al. (2012), Maditinos, Chatzoudes, and Tsairidis (2012), Uchitha Jayawickrama, Liu, and Hudson Smith (2014)
2	Knowledge creation	Vandaie (2008), Jeng and Dunk (2013)

2.3 Knowledge retention (k-retention) phase:

There is a lack of studies carried out in detail on knowledge retention for ERP implementation. Nevertheless, k-retention has been discussed with the other phases of KM lifecycle. It is important to retain the knowledge during implementation that has already been created and transferred in order

to use that knowledge in subsequent stages of the implementation (Sedera and Gable 2010). Retained knowledge includes knowledge residing in various forms, including written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organisational procedures and processes and tacit knowledge acquired by individuals and networks of individuals (Tan et al. 1999). Parry and Graves (2008) discuss the importance of knowledge management for ERP projects using four phases of KM lifecycle and it includes knowledge retention. Candra (2014) used knowledge retention to investigate knowledge capability. He argued that an organisation's capability is dependent on the knowledge it retains for innovation and new knowledge generation. Gable (2005) explains that consulting firms attempt to provide more efficient implementation experience as possible for their clients by helping them to retain the ERP knowledge in sufficient levels. Thereby, the retained knowledge can be used not only during implementation but also in future roll outs and major upgrades (Sedera and Gable 2010; Villa and Taurino 2017; Dwaikat et al. 2018).

2.4 KM and ERP in SME context

Although there are several research studies focused on ERP in SMEs (Shin 2006; Ruivo, Oliveira, and Neto 2012; Amani and Fadlalla 2016), there are a small number of research studies focused on knowledge management and ERP in the context of SMEs. Metaxiotis (2009) aims to explore the rationales for the integration of knowledge management and ERP in SMEs and to present a conceptual model for their integration. The proposed conceptual model is regarded as an adaptable solution, where an SME with a traditional business structure uses existing IT applications and builds on them. Before applying the proposed model, SMEs should ensure that their KM initiatives fit into their organisational culture, or otherwise they should be prepared to change it. Much of the literature on KM has focused on KM practices in large organisations where KM seems to encompass every KM process from capture of knowledge to its eventual reuse (Shin 2006; Ruivo, Oliveira, and Neto 2012). A game–theoretic framework for analysing interorganisational knowledge sharing under co-opetition and guidelines for the management of explicit knowledge predicated on coordination and control theory has been proposed by Levy, Loebbecke, and Powell (2003). This research empirically investigates these issues in the context of SME. SMEs provide an interesting setting as they are knowledge generators but are poor at knowledge exploitation. This study does not specifically focus on ERP. Small and medium-sized enterprises practise KM processes to a lesser degree or differently owing to their special characteristics and limitations (Metaxiotis 2009). Supyuenyong, Islam, and Kulkarni (2009) investigate how the special characteristics of SMEs influence their KM processes in their qualitative study with ERP service providers. The findings demonstrate that, in general, ownership and management structure as well as culture and behaviour characteristics of SMEs seem to have a more positive effect than other SME characteristics on KM processes. System, process and procedure, and customer and market characteristics have a more moderate effect. Human capital management seems to hinder somewhat rather than facilitate KM processes. However, none of the studies on this domain were able to investigate on knowledge retention for ERP implementation in particular. If SMEs can have a robust knowledge retention approach, that would result SMEs having more reusable knowledge in medium to long run, practical cost-effective k-retention initiatives, and less organisational memory loss. Therefore, it is evident that there is a considerable need for empirical research in this domain.

2.5 Research gaps identified

There are three key research gaps identified based on the existing literature on this domain;

1. Lack of in-depth empirical research on ERP knowledge retention.
2. Lack the integration of knowledge types and knowledge retention phase in order to investigate the knowledge retention for ERP implementation.
3. No empirically defined frameworks/models to drive knowledge retention activities during ERP implementations; including SME sector.

This study attempts to bridge the research gaps identified in existing literature using empirical data collected from SMEs in UK industries by answering two specific research questions:

RQ1. How different types of ERP implementation-related knowledge need to be retained?

RQ2. What factors influence knowledge retention in ERP implementation in SMEs?

3. Research methodology

This section discusses the adoption of grounded theory approach for this research inquiry, empirical data collection procedure carried out, and data analysis method adopted in this study.

3.1 Grounded theory approach

The study uses the grounded theory approach (Glaser and Strauss 1967). In the grounded theory approach, qualitative data is gathered and used to guide the theory building process. The data collection phase used case studies with in-depth interviews, informal discussions, and project documentations in the context of ERP implementations. The in-depth interviews were carried out to identify knowledge retention practices in ERP implementations, develop core categories for organising the data, and applied the theoretical concepts gathered from the interviews to depict the relevance of the theories of alignment strategies in the context of ERP knowledge retention in SMEs.

While enterprise systems (ES/ERP) research is proliferating, no published studies were found that specifically examined the knowledge retention approaches resulting in successful ERP implementation, as well as drivers that may have contributed to the knowledge retention being more or less complex. For such areas, where the knowledge base is still small, the utilisation of case study methodology is suggested, enabling the collection of detailed information (Yin 2003). This approach for collecting data, deriving insights and conclusions, and even develop theory has become quite popular (Eisenhardt and Graebner 2007), with several researchers discussing the rigor and benefits of case study research (Voss, Tsikriktsis, and Frohlich 2002; Hellens, Nielsen, and Beekhuyzen 2005; Dey, Clegg, and Cheffi 2011). Case study methodology has frequently found application in the operations management literature (Wacker 1998; Closs et al. 2008), and more specifically also in research studying ERP implementations (Schoenherr et al. 2010; Galster and Avgeriou 2015), deeming the approach as the most suitable for exploring dimensions of knowledge retention in ERP implementations and its drivers.

3.2 Data collection

For the selection of our case studies/implementations we employed theoretical sampling (Voss, Tsikriktsis, and Frohlich 2002; Eisenhardt and Graebner 2007). Our goal was to select true UK SMEs

that are known to be especially innovative, proactive and successful, to ensure that the ideas developed will have practical value for other firms (Supyuenyong, Islam, and Kulkarni 2009). This research attempts to collect empirical evidence from experienced people who have been directly involved in off-the-shelf ERP systems implementation in UK SMEs.

Specific criteria for recruiting suitable interview participants for this study have been defined based on the nature of the research demands (S Newell et al. 2003; Jones, Cline, and Ryan 2006). The criteria are: (1) The participants must have directly involved in off-the-shelf ERP systems implementation (such as SAP and Oracle) but not in-house developed systems/bespoke systems, including the respective case implementation in the UK SME. This is because off-the-shelf ERP systems are very different from bespoke systems in that off-the-shelf systems are more standardised, hence the empirical evidence collected would offer guidance to a wider range of beneficiaries. (2) The participants must have at least 10 years of experience in ERP field including in SMEs, to ensure that the participants have high level of skill, more refined experience or expertise, and ability to clearly distinguish the SME context from large enterprise context. Therefore, SME case implementations were channel downed and selected through the filtering of participants using set criteria. One-to-one in-depth interviews were carried out with ERP experts from 12 SMEs in the UK which have implemented off-the-shelf ERP systems. Appendix A provides an overview of the companies, interviewees and ERP systems implemented. SMEs are from both manufacturing and service sector companies, and they have employees between 0 and 249 and annual turnover not exceeding €50 million for them to be considered as a SME based on the EU definition of SME (Schoenherr et al. 2010). Each interview lasted for 2 hours on average to allow participants plenty of time to elaborate on their opinions. The experts largely held senior/middle management positions in ERP client and implementation partner companies and this helped to obtain the fine details of what happened during the ERP projects with respect to knowledge retention in particular.

The company case implementations were investigated with three different sources of evidence for triangulation: (1) the data collected from one-to-one in-depth interviews, (2) ERP project related documents and (3) the data obtained from informal discussions. The coded data obtained from interviews, informal discussions and ERP project documents have been validated with the respective companies to ensure data validity and reliability.

3.3 Data analysis

Thematic analysis fully supports for theory building process in grounded theory approach using qualitative data (Snider, Silveira, and Balakrishnan 2009; Closs et al. 2008). Thematic analysis was used to allow new patterns to emerge from the interview transcripts, discussion notes and project documents in order to discover the various methods/tools/practices of knowledge retention related to different knowledge types. Subsequently, the identified knowledge retention practices were categorised under specific titles. Thematic analysis is one of the approaches in analysing qualitative data; it concentrates on the themes or subjects and patterns, emphasising, pinpointing, examining, and recording patterns within the data (Braun and Clarke 2006). Thematic analysis is normally concerned with experience focused methodologies. Throughout the analysis, the researcher identified a number of themes by considering the following three stages highlighted by King and Horrocks (2010):

Descriptive coding (***first-order codes***): the researcher identifies those parts of the transcript data that address the research questions and allocates descriptive codes throughout the whole transcript.

Interpretative coding (***second-order themes***): the researcher groups together descriptive codes that seem to share some common meaning and creates an interpretative code that captures this.

Defining overarching themes (***aggregate dimensions***): the researcher identifies a number of overarching themes that characterise key concepts in the analysis.

The second-order themes were identified using first-order codes, and they were categorised as aggregated dimensions to reveal knowledge retention practices which result in retaining different types of knowledge in right levels (see Table 3 for instance of ERP package knowledge retention). Based on the categorisation and theme analysis techniques suggested by Miles and Huberman (1994), the researcher read each interview transcript several times and coded each one separately on the basis of terms or phrases used by the participants.

Table 3: Empirical evidence in discovering ERP package knowledge retention practices

First-order codes (sample)	**Second-order themes**	**Aggregate dimensions / categories**	
"...knowledge retention tools and I think that you do want that at minimum a share drive and it has all the information that comes out of the project that you retain and you keep up the date." – Head of IT.	Share drive	***K-retention tools***	***ERP package knowledge retention***
"What we observed was vendor KM system has supported for knowledge retention activities within the project team members..." – Project manager.	ERP vendor specific tools		
"If you got an organisation that does have a very formal automated KM system, then yes you should use that for the implementation. Trying to use one just for the implementation will not work because you are setting up all new if people aren't already used to the limitations of it..." - Head of business solutions.	Separate KM systems		
"We got knowledge from help desk ticket point of view as well. But there is a cost associated the moment you raise more tickets" – Managing director	Help desk systems		
"It's very much the same as solution manager being key, the intranet for awareness and to be able to get to a wider audience and communication." - Solution architect	Intranet		
"All our documents were either word documents or project documents or designs etc all of that was captured in the share point and made available to whole of that community using it." – Manager IT.	MS share point		
"The key knowledge that you'll hope within an organisation is what your organisation does, what the business processes are that support the operation on that business… The business being able to define what it wants." – Business systems manager.	Business bulletin	***Documentation***	
"They first need to go through the user guides, help manuals, script sheets and if they can't find still they need to go to their super user, before they approach a TSD or a help desk." - IT Systems Manager.	User guides		

"…because the test script has to be very precise we can reverse engineer as to what the change that was made." – Business systems manager.	Test scripts		
"… There is also the training material which is developed. And all of that seem the testing scripts and all the documents all of which is a vast wealth of knowledge that can evolve, through the implementation journey." - IT delivery manager	Training manuals/materials		
"The functional knowledge of the solution which is again documented in functional documents. There is also the training material which is developed. And all of that seem the testing scripts and all the documents all of which is a vast wealth of knowledge…" - Independent consultant – freelance.	Functional documents		
"Timely and adequate support from business representatives is a must to drive knowledge retention activities according to our experience during the implementation" - Solution architect.	Progress reports		
"When finalising on customisation points, it is very important the top management guidance to overcome employees cultural issues and to properly document customisations through technical design documents." - Change Management Lead	Customisations/enhancements		
"The standard operating procedures telling how you achieve your business processes using the ERP package system. And they are vital to retain knowledge for future reuse." - IT program manager	SOP (standard operating procedures)		
"Project team members need to be people who are very knowledgeable of their particular process area. They need to be empowered and that is the key thing. They need to be able to make a decision without going through many, many levels of management… If you can get those right people on the project team, then you will get good knowledge transfer…" - Independent consultant – freelance.	Client	***Human capital***	
"To apply knowledge in subsequent stages of the project, we must retain right knowledge in right quantities. The competencies of the consultants matter a lot to have such knowledge on board..." – Managing director.	Implementation partner (IP)		
"We had some contract business analysts who came in to do that documentation work which therefore helped the consultants because they could save time." - Head of IT	Business analyst/documentation specialist		

"Retention of ERP package knowledge is very important to prevent organisational memory loss when employees start leaving after the implementation." - IT delivery manager	Needs of k-retention	***Why k-retention? and challenges***	
"One of the challenges is that most companies don't update that documents or take care of those documents once the project has gone live, so issues after changing the support partner." – Project manager.	Challenges of k-retention		

4. Empirical findings

This section discusses empirical findings related to ERP package knowledge retention, business process knowledge retention, how project management and organisational culture positively influence retention of both types of knowledge, and formulation of ERP knowledge retention (EKR) framework.

4.1 Retaining knowledge related to ERP package

Based on empirical findings, there are four elements which support for knowledge retention of ERP package knowledge (see Figure 1). They are knowledge retention tools, documentation, human capital, and understanding of knowledge retention challenges and needs for knowledge retention. Figure 1 has been developed using thematic analysis method discussed previously, based on empirical evidence shown in Appendix B. Various k-retention tools have helped SMEs to retained ERP package knowledge; such as share drive, ERP vendor specific tools, separate KM systems, help desk systems, intranet and Microsoft share point. A popular and cost effective method is placing a shared folder/drive on one of company's servers. It can be done by assigning right access levels to project members with read/write privileges to the documents resides in shared folders. ERP vendors have their own tools for knowledge retention during ERP implementation. Based on case implementations, it is evident that clients have effectively used ERP vendor specific tools such as SAP Solution Manager, Oracle My Support, etc. in order to manage configurations and enhancements, and functional specifications. Case companies who already had a knowledge management culture within the organisation, have used a separate KM system as a tool to retain ERP package knowledge. However, for organisations who have not used KM systems in day-to-day operations, it may not be practical to use a KM system just only for the ERP implementation because there is a high tendency of project members get overloaded with using a KM system back of an ERP implementation (U. Jayawickrama, Liu, and Hudson Smith 2016). Based on the empirical findings, there have been two types of KM systems used by clients; in-house developed KM systems and off-the-shelf KM systems. Microsoft Share Point was also a popular tool among slightly established SMEs. Empirical evidence shows that help desk systems and company's intranet can be used as effective knowledge retention tools during ERP implementation.

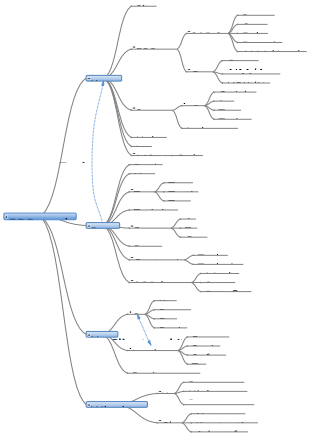

Figure 1: ERP package knowledge retention

Empirical evidence clearly indicates that one of the effective and affordable methods to retain ERP package knowledge is through structured documentation. Documentation can be in various formats

as shown in Figure 1. Business bulletin helps to communicate important project updates to employees which includes the status of the project using dashboards, high priority project tasks, updated version of the project plan, and next steps of the project. Well directed user guides are popular among SMEs to retain ERP package knowledge. They have step-by-step procedures to use different functions of the system. More commonly they are structured based on the different job roles of the organisation. Furthermore, test scripts help to retain knowledge related to ERP implementation such as what and why decisions took in terms of using standard system functionalities versus customisations. Therefore, they are good records to always come back and visit when enhancing product functionalities in future. Based on empirical findings, SMEs have used test scenarios depend on different business processes, testing databases to cover a range of test cases, and some specialist testing tools which automate testing to a certain degree. Preparation of functional documents is seen as mandatory to retain ERP package knowledge by SMEs. They are mainly in three types; As-Is, To-Be and Gap analysis documents. As-Is document templates help to document the existing business processes of the client organisation which is important to identify the issues in the current processes and systems in place and design the solution using the functionalities of the ERP system. To-Be refers as the solution design in other words proposed solution using the ERP system. Therefore, correctly documenting the solution is important in many ways including; it acts as a milestone document to obtain sign-off from client to proceed with the configuration step of the implementation. Some case SMEs have shown the evidence of doing a Gap analysis by investigating and evaluating existing business processes and this document also highlights what system can do and cannot do. Apart from functional documents, standard operating procedures (SOP) have been used to document the interactions between modules, configurations/setups and data flows between modules. Project managers from both client and implementation partner jointly prepare the project progress reports to present to the key stakeholders of the project (steering committee members), which indicate where the project is heading, issues they have in hand, what the team jointly proposes to resolve those issues and what strategic directions and help they need to make better progress. Based on the empirical evidence, it can be seen that the knowledge of customisations and enhancements to the ERP system is retained through technical analysis and technical design documents. As indicated in Figure 1, knowledge retention tools can offer various support for documentation, for instance; ERP vendor specific tools have structured documentation templates to guide and support in preparing As-Is, To-be and Gap analysis documents.

The effective interaction between parties (human capital) who involve in the ERP project is vital for retention of ERP package knowledge based on SME case studies. Client side mainly comprises of key users (specialist in a certain area within a department), process champions (usually a department manager), end users, and project manager. Implementation partner project team largely consists of functional consultants (who investigates the current processes and design the solution to configure the system based on business requirements), software developers (to help with developing custom reports, forms and custom interfaces with other legacy systems), testers, and project manager. According to empirical findings, it is evident that client team and implementation partner team work jointly and collaboratively to retain adequate level of ERP package knowledge and thereby achieve ERP project success. Some case implementations have used documentation specialist dedicated to correctly document ERP package knowledge.

It is important to understand challenges in knowledge retention and needs for ERP package knowledge retention during implementation (U. Jayawickrama, Liu, and Hudson Smith 2016). Retaining adequate level of ERP package knowledge makes client less dependent on support

partner, because client has retained necessary knowledge to deal with post-implementation system issues with minimum help from support partner/implementation partner. Empirical findings confirm the fact that higher the customisations, higher the knowledge that needs be retained. If a SME retained right level of ERP package knowledge, it can mitigate organisational memory loss although employees leave the job after the ERP implementation. Even though, knowledge retention has many benefits to SMEs, there are some challenges too. Not updating documents often to retain latest knowledge can be considered as serious challenge. Knowledge retention has not considered as a continuous practice. When the time passes by, client tends to forget gathering required new knowledge and retain them regular basis. Being SMEs who may not have habits in following best/standardised practices, it is challenging to adopt for KM tools and strategies. With the support of Figure 1, it can be summarised that knowledge retention tools, documentation, human capital, and understanding of knowledge retention challenges and needs for knowledge retention are required for retention of ERP package knowledge for SMEs.

4.2 Retaining knowledge related to business processes

There are some similar tools and documentation methods being used for retention of both business process knowledge and ERP package knowledge such as intranet, MS share point, share drive, ERP vendor specific tools, and As-Is documents. However, as shown in Figure 2, documentation methods such as list of business requirements, Visio flow charts, process diagrams and work instructions documents are specifically used to retain business process knowledge by SMEs. Empirical data demonstrate the importance of drawing process diagrams and flow charts by dividing large processes into sub-processes in order to correctly visualise the existing business activities of the organisation. Moreover, business requirements can be prioritised based on the criticality of each to achieve overall business performance. Being SMEs, there is always room for improvements by eliminating non-value adding business activities. In order to improve the business processes through ERP implementation, it is vital to thoroughly understand the existing business processes. In the process of retaining business process knowledge, human capital involved in the project plays a crucial role. Client project team members and implementation partner project team work jointly and collaboratively to retain business process knowledge as similarly in ERP package knowledge. Based on empirical findings, dedicated business analyst/documentation specialist have been used to document existing business processes effectively.

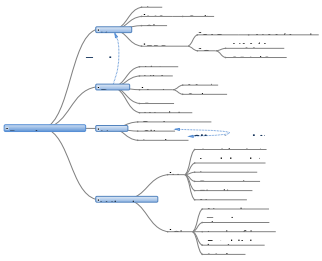

Figure 2: Business process knowledge retention

Understating why a SME needs to retain business process knowledge is essential. There are several reasons for that; to avoid missing critical processes, to look back in time to see changes made in past and why, to improve existing business processes, to determine the returns that a SME gets out from ERP implementation, to finalise the customisation points, and if there is no previous As-Is documents and process diagrams in the organisation. Although there are sloid justifications to retain business process knowledge, it is evident that there are challenges to overcome to retain right level of business process knowledge (see Figure 2). Some SMEs do not have a culture/discipline within the organisation to use KM tools and follow KM strategies. The top management (including owners) interference is vital to practice proper knowledge retention methods. Organisations tend to directly jump into solution design, hence miss in depth investigations on critical business processes. Lack of knowledge to use/refer documents, lack of establishing common understanding of business process knowledge retention, and lack of making easy access to documentation are among challenges to retain business process knowledge. The proper awareness through workshops and meetings with the support of steering committee members are essential to overcome these knowledge retention challenges.

4.3 Project management (PM) for knowledge retention

The nature of ERP projects and aspects of ERP project management help to retain knowledge in required levels. ERP project management documentation, nature of ERP projects, role and responsibilities of client side project manager, and project team (both client and implementation partner) are key influential factors for effective knowledge retention during ERP implementation in SMEs (see Figure 3). Based on empirical evidence, distributing project newsletters is a popular and cost-effective method in SMEs to communicate the current status of the project to a wider audience within the client company. Whereas weekly status reports have been used to communicate project progress to top management. Senior managers would like to see dashboards for project monitoring because it is much easier to read a dashboard than reading a report. Some SMEs have used Microsoft share point and cost-effective wikis for communication purposes within project team members, hence it was able to retain knowledge on ERP package and business processes through these project management documentation tools.

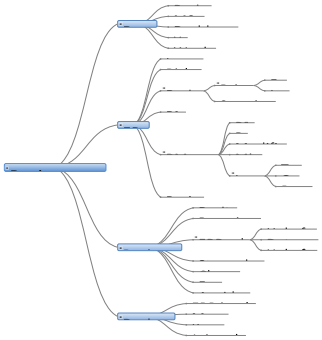

Figure 3: Project management (PM) for k-retention

Risk management and issue management in ERP projects are important for ERP success (Singla and Goyal 2006; Dey, Clegg, and Cheffi 2011). Being SMEs, they learn from these PM activities which lead to retaining knowledge related to ERP package and existing business processes. As shown in Figure 3, project management discussions are of two types; briefing sessions and steering committee meetings. Briefing sessions could be formal or informal sessions. Mostly SMEs use informal sessions to help retain vital knowledge related to ERP project, since they have flat hierarchies in the organisation. Adhering to project management rules positively influences to retain knowledge in right levels. Moreover, according to empirical data, ERP projects in SMEs have been managed using various popular PM techniques/approaches such as PRINCE2, PMP, modified versions of above two, mixed versions of above two to suit for ERP projects in SMEs, and lessons learnt approach. Lessons learnt are of three types; technical lessons, cultural lessons and process change lessons. Thereby, SMEs attempt to develop the skills required to manage and maintain the system once it is gone live, because they cannot afford high fees of support agreements from ERP consulting companies. These PM techniques have been introduced to SME ERP projects by implementation partners with the intention of achieving project success through proper knowledge management. The project can be governed properly by understanding the nature of ERP projects as oppose to software development projects, and using right PM rules and techniques.

The role of client side project manager is a crucial role in ERP projects especially to lead the project team members to retain vital knowledge within the organisation (Sedera and Gable 2010). Therefore, the top management of the client company should ensure that they recruit the right project manager within the company who has a solid understanding about organisational work culture, positional authority, strong business process knowledge, and competence to be a good facilitator and a change manager. Empirical data show that client side project manager should not necessarily have knowledge about the ERP system going to be implemented in the SME. But ERP related PM knowledge is somewhat important for this role to manage the project effectively, particularly in the SME context (see Figure 3). ERP related PM knowledge refers to knowledge on ERP project budgeting, resource estimation and resource planning, and determining key deliverables and milestones. To take a decent control of the project tasks without unnecessarily depending on the implementation partner, SME should have a solid project manager in place before starting the implementation. Positional authority refers to the ability/power of taking quick vital decisions about the project without going through company hierarchy. This is essential for the project manager to avoid pulling resources out from the project unexpectedly for day-to-day business operations. In many situations, this would be earlier since SMEs have flat organisational hierarchies. In addition, a project manager with right positional authority would ensure to keep all resources in place to retain adequate knowledge during ERP implementation.

As described previously, ERP project team consists of team members from both client and implementation partner. In the context of SMEs, both parties jointly plan and execute the project tasks because some SMEs do need more direction and support from implementation partner; in situations like when the client does not have experienced project manager and/or project team members who do not have ERP project experience before in their careers. Empirical evidence show that implementation partner introduces suitable ERP implementation methodology to the client which should be followed during the project based on the ERP package that they implement. Furthermore, the project team must ensure achieving project deadlines and key milestones in order to retain relevant knowledge, in right levels at right time of the project while reducing knowledge

losses. The PM aspects discussed in this section create a healthy atmosphere to retain both ERP package and business process knowledge.

4.4 Organisational culture for knowledge retention

Organisational culture plays a vital role in knowledge management during ERP implementation (Metaxiotis 2009; Supyuenyong, Islam, and Kulkarni 2009). In SME context, human capital collaboration in other words effective collaboration between individuals involved in the project is important for the retention of ERP package knowledge and business process knowledge. As shown in Figure 4, the effective and smooth collaboration between individuals and parties can be established through good governance, capability and experience of implementation consultants, network of change agents, formal and personal relationships with business users, positive work relations, and qualified experienced business users.

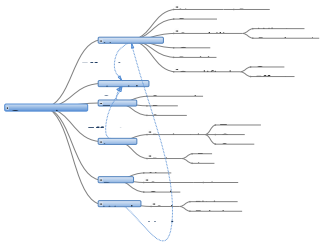

Figure 4: Organisational culture for k-retention

As per empirical findings, top management support is required in various ways to create a positive atmosphere for knowledge retention during ERP implementation. Top management provide strategic direction and guidance, direct support to sell the project within the organisation, and sponsor the project in all ways including funds. Moreover, it is vital to get the involvement of all parties (such as end users, key users, process champions, etc.) initially through project introduction workshops. These workshops are comprised of team building activities, communicate ground rules and company overview. Formal and inform briefing sessions are also helpful to obtain effective involvement of all parties to achieve project success by creating a positive environment for knowledge retention. Avoid resistance of employees towards implementing the ERP system is

essential to retain relevant knowledge during the project. As shown in Figure 4, resistance barriers can be avoided through effective collaboration/communication and involvement between all parties, and through the strategic support from top management (including owners).

It is evident that there are several documents to understand organisational culture of the client company for implementation partner (and steering committee) to put in place suitable knowledge retention tools discussed previously. They are; communication protocols (which include access hierarchy/chain of command), company newsletters, and on board pack for consultants who join the project team middle of the project. Furthermore, it is important to understand sub-cultures of the client company because in turn this would help to understand work cultures of the business users to ensure effective collaboration between sub-teams within the project in order to promote the use of knowledge retention tools and methods.

4.5 Formulation of ERP knowledge retention (EKR) framework

The building blocks of constructing the ERP knowledge retention (EKR) framework for SMEs are Figure 1, Figure 2, Figure 3 and Figure 4, they have been discussed in previous sections with empirical evidences. EKR framework can be seen in Figure 5. The framework consists of several components which have been derived from Figure 1 to 4. ERP package knowledge retention and business process knowledge retention commonly share the aspects of k-retention tools, documentation, human capital, and needs and challenges of k-retention in SMEs during ERP implementations. However, in order to read what each of these four aspects comprised of with respect to ERP package k-retention and business process k-retention, it is essential to refer Figure 1 and Figure 2. The framework demonstrates how project management and organisational culture positively influence knowledge retention of both ERP package and business process knowledge in SME ERP implementations. Moreover, in order to see how the framework components of project management for k-retention and organisational culture for k-retention have enriched knowledge retention in SME ERP implementations, it is required to refer Figure 3 and Figure 4. EKR framework can be viewed as the consolidated solution to answer two research questions defined initially.

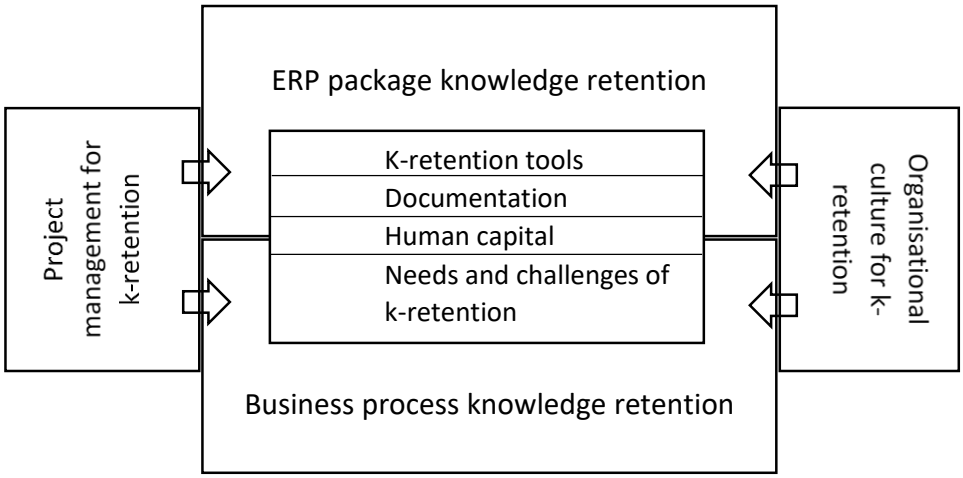

Figure 5: ERP knowledge retention (EKR) framework for SMEs

5. Discussion and conclusions

This study reveals EKR framework which consists of several key components based on the empirical findings in the context of SMEs which would be helpful to industry practitioners both client and implementation partners. Although knowledge retention phase was examined as a part of the KM lifecycle through past literature, this was the first attempt to fully investigate on knowledge retention in ERP implementation.

This study and Parry and Graves (2008) equally demonstrate how the documentation determines the retention of up-to-date and relevant knowledge. The common knowledge retention driver is documentation based on literature which further demonstrates the relevance of the documentation for knowledge retention (Parry and Graves 2008; Tsai et al. 2011; Candra 2014). Additionally, this study was able to specify what types of documents (such as user guides, functional documents, progress reports, Visio flow charts, process diagrams, etc.) are needed to retain different types of knowledge (such as ERP package knowledge and business process knowledge). All kinds of ERP project related knowledge and process experiences would be documented using various forms such as user manuals, test scripts, other graphics and text-based media. SMEs who consider in implementing ERP systems in future can channel through the Figures 1 to 4 and obtain various methods and directions in retaining knowledge during ERP implementation. Tsai et al. (2011) state that organisations record knowledge and experiences of users using the tools provided by ERP vendors. They also suggest use of a separate KM system to retain knowledge during implementation. However, this study reveals that what type of separate KM systems and how they can be used to retain ERP package knowledge and business process knowledge during ERP implementations in SMEs. S Newell et al. (2003) pointed out the implementation of ERP system and KM system simultaneously to achieve ERP success and knowledge retention capability. L. Xu et al. (2006) argue in a similar manner and attempt to implement KM system and ERP system concurrently in order to achieve the effects of integrating both systems. Thereby, KM system can be used to retain the knowledge which would be created and transferred during ERP implementation. Nevertheless, this study demonstrates how human capital should collaboratively work to retain relevant knowledge during ERP projects by mitigating challenges of knowledge retention.

This study also reveals the importance of project management and organisational culture in order to retain different types of knowledge which would be helpful to industry practitioners. Moreover, it shows how these two factors positively influence ERP package knowledge retention and business process knowledge retention. Metaxiotis (2009) explored the rationales for the integration of knowledge management and ERP in SMEs. However, current study went one level deeper to investigate on knowledge retention for ERP implementations in SMEs. Supyuenyong, Islam, and Kulkarni (2009) investigated how the special characteristics of SMEs influence their KM processes in general without any reference to KM lifecycle phases. However, current study was able to deeply investigate on knowledge retention phase using grounded theory approach with respect to two key knowledge types. This section clearly demonstrates how the two research questions defined in the second section have been answered through the empirical findings of this study.

Although the empirical findings of this study are promising and valuable, a few limitations have been recognised which will be considered by the researchers in their future work. This study only covers off-the-shelf ERP systems implementation, not bespoke ERP systems implementation. The empirical data were collected from UK implementations in SMEs without data from ERP implementations in the developing economies. Further research will address the above limitations in order to make this study more rigorous.

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Appendices

Appendix A: Details of case implementations

No	Nature of the business	Number of employees	ERP name	Number of modules implemented	Scope of the ERP implementation	Implementation duration	Designation of the interview participant	ERP experience
1	Advertising	220	SAP	8	Finance and Operations	1.5 years	Head of IT	15 years
2	Market research	180	Oracle	10	Finance and SCM	1 year	IT Systems Manager	12 years
3	Waste management	220	Oracle	16	Finance, HR, CRM and Operations	2 years	Head of Business Solutions	12 years
4	Media	240	SAP	15	Finance, HR and CRM	1.5 years	Manager IT	10 years +
5	Automobile parts manufacturing	100	Oracle	14	Finance, HR, SCM, CRM and Production	2 years	Solution Architect	12 years
6	Medical surgery equipment manufacturing	240	SAP	15	Finance, HR, SCM and CRM	1.5 years	Business Systems Manager	16 years
7	Aerospace equipment manufacturing	220	SAP	10	Finance and manufacturing	2 years	Independent Consultant - Freelance	17 years
8	Food distributing	170	SAP	18	Finance, manufacturing, SCM, CRM and HR	3 years	Change Management Lead	15 years
9	IT services	240	Oracle	12	Finance, HR and BI	1.5 years	Project Manager	12 years
10	Property agent	80	Oracle	8	Finance	1.2 years	IT Delivery Manager	16 years
11	Food retail	150	Oracle	6	Finance and HR	1.5 years	IT Program Manager	10 years +

12	Steel manufacturing	210	Oracle	12	Finance, manufacturing and CRM	1.5 years	Managing Director	18 years